BEFORE THE
PUBLIC SERVICE COMMISSION OF
SOUTH CAROLINA
DOCKET NO. 2019-3-E

In the Matter of Annual Review of Base Rates for Fuel Costs for Duke Energy Carolinas, LLC , Increasing Residential and Non-Residential Rates	)))))	**DIRECT TESTIMONY OF** **STEVEN D. CAPPS FOR** **DUKE ENERGY CAROLINAS, LLC**

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Steven D. Capps and my business address is 526 South Church Street, Charlotte, North Carolina.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am Senior Vice President of Nuclear Operations for Duke Energy Corporation ("Duke Energy") with direct executive accountability for Duke Energy's South Carolina nuclear plants, including Duke Energy Carolinas, LLC's ("DEC" or the "Company") Catawba Nuclear Station ("Catawba") in York County, South Carolina, the Oconee Nuclear Station ("Oconee") in Oconee County, South Carolina, and Duke Energy Progress, LLC's ("DEP") Robinson Nuclear Plant, located in Darlington County, South Carolina.

Q. WHAT ARE YOUR RESPONSIBILITIES AS SENIOR VICE PRESIDENT OF NUCLEAR OPERATIONS?

A. As Senior Vice President of Nuclear Operations, I am responsible for providing executive oversight for the safe and reliable operation of Duke Energy's three South Carolina operating nuclear stations. I am also involved in the operations of Duke Energy's other nuclear stations, including DEC's McGuire Nuclear Station ("McGuire") located in Mecklenburg County, North Carolina

Q. PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I have more than 32 years of experience in the nuclear field. I joined Duke Energy in 1987 as a field engineer at Oconee. During my time at Oconee, I served in a variety of leadership positions at the station, including Senior Reactor Operator, Shift

Technical Advisor, and Mechanical and Civil Engineering Manager. In 2008, I transitioned to McGuire as the Engineering Manager. I later became plant manager and was named Vice President of McGuire in 2012. In December 2017, I was named Senior Vice President of Nuclear Corporate for Duke with direct executive accountability for Duke Energy's nuclear corporate functions, including nuclear corporate engineering, nuclear major projects, corporate governance and operation support and organizational effectiveness. I assumed my current role in October 2018. I earned a B.S. in Mechanical Engineering from Clemson University.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to describe and discuss the performance of DEC's nuclear fleet during the period of June 1, 2018 through May 31, 2019 (the "review period").

Q. YOUR TESTIMONY INCLUDES THREE EXHIBITS. WERE THESE EXHIBITS PREPARED BY YOU OR AT YOUR DIRECTION AND UNDER YOUR SUPERVISION?

A. Yes. These exhibits were prepared at my direction and under my supervision.

Q. PLEASE PROVIDE A DESCRIPTION OF THE EXHIBITS.

A. The exhibits and descriptions are as follows:

Capps Exhibit 1 - Calculation of the nuclear capacity factor for the review period pursuant to S.C. Code § 58-27-865

Capps Exhibit 2 - Nuclear outage data for the review period

Capps Exhibit 3 - Nuclear outage data through the billing period [1]

Q. PLEASE DESCRIBE DEC'S NUCLEAR GENERATION PORTFOLIO.

A. The Company's nuclear generation portfolio consists of approximately 5,389[2] megawatts ("MWs") of generating capacity, made up as follows:

Oconee - 2,554 MWs

McGuire - 2,316 MWs

Catawba - 519 MWs[3]

Q. PLEASE PROVIDE A GENERAL DESCRIPTION OF DEC'S NUCLEAR GENERATION ASSETS.

A. DEC's nuclear fleet consists of three generating stations and a total of seven units. Oconee began commercial operation in 1973 and was the first nuclear station designed, built, and operated by DEC. It has the distinction of being the second nuclear station in the country to have its license, originally issued for 40 years, renewed for up to an additional 20 years by the NRC. The license renewal, which was obtained in 2000, extends operations to 2033, 2033, and 2034 for Oconee Units 1, 2, and 3 respectively.

McGuire began commercial operation in 1981 and Catawba began commercial operation in 1985. In 2003, the NRC renewed the licenses for McGuire and Catawba for up to an additional 20 years each. This renewal extends operations until 2041 for McGuire Unit 1, and 2043 for McGuire Unit 2 and Catawba Units 1 and 2. The Company jointly owns Catawba with North Carolina Municipal Power

[1] This data is provided in confidential and publicly redacted versions for security purposes.
[2] Based on Net Maximum Dependable Capacity as of January 1, 2019.
[3] Reflects DEC's 19.2 percent ownership of Catawba Nuclear Station.

Agency Number One, North Carolina Electric Membership Corporation, and Piedmont Municipal Power Agency.

Q. WHAT ARE DEC'S OBJECTIVES IN THE OPERATION OF ITS NUCLEAR GENERATION ASSETS?

A. The primary objective of DEC's nuclear generation department is to safely provide reliable and cost-effective electricity to DEC's Carolinas customers. The Company achieves this objective by focusing on a number of key areas. Operations personnel and other station employees are well-trained and execute their responsibilities to the highest standards in accordance with detailed procedures. The Company maintains station equipment and systems reliably, and ensures timely implementation of work plans and projects that enhance the performance of systems, equipment, and personnel. Station refueling and maintenance outages are conducted through the execution of well-planned, well-executed, and high-quality work activities, which effectively ready the plant for operation until the next planned outage.

Q. PLEASE DISCUSS THE PERFORMANCE OF DEC'S NUCLEAR FLEET DURING THE REVIEW PERIOD.

A. The Company operated its nuclear stations in a reasonable and prudent manner during the review period, providing 60 percent of the total energy generated by DEC. The seven nuclear units operated at an actual system average capacity factor of 96.05 percent for the review period which included four refueling outages.

As shown on Capps Exhibit 1, DEC achieved a net nuclear capacity factor, excluding reasonable outage time, of 101.45 percent for the review period. This

capacity factor is above the 92.5 percent set forth in S.C. Code § 58-27-865(F), which states in pertinent part:

> There shall be a rebuttable presumption that an electrical utility made every reasonable effort to minimize cost associated with the operation of its nuclear generation facility or system, as applicable, if the utility achieved a net capacity factor of ninety-two and one-half percent or higher during the period under review. The calculation of the net capacity factor shall exclude reasonable outage time associated with reasonable refueling, reasonable maintenance, reasonable repair, and reasonable equipment replacement outages; the reasonable reduced power generation experienced by nuclear units as they approach a refueling outage; the reasonable reduced power generation experienced by nuclear units associated with bringing a unit back to full power after an outage....

The performance results discussed above support DEC's continued commitment for achieving high performance without compromising safety and reliability.

Q. HOW DOES DEC'S NUCLEAR FLEET COMPARE TO INDUSTRY AVERAGES?

A. Industry benchmarking efforts are a principal technique used by the Company to ensure best practices. Duke Energy's nuclear fleet continues to rank among the top performers when compared to other large domestic nuclear fleets using Key Performance Indicators ("KPIs") in the areas of personal safety, radiological dose, manual and automatic shutdowns, capacity factor, forced loss rate, industry performance index, and total operating cost. On a larger industry basis using 2018 data from the Electric Utility Cost Group, all three of DEC's nuclear plants rank in the top quartile in total operating cost among the 60 U.S. operating nuclear plants. By continually assessing the Company's performance as compared with industry

benchmarks, the Company continues to ensure the overall safety, reliability and cost-effectiveness of DEC's nuclear units.

Additionally, for 19 consecutive years DEC's nuclear plants have surpassed a 90 percent annual capacity factor threshold. As a result of this strong operational performance, the Company has produced approximately 39.5 million MWHs of additional generation, which is equivalent to an additional 8.2 months of output (based on DEC's average annual generation for the same 19-year period). These performance results support DEC's continued commitment to achieving high performance without compromising safety and reliability.

Q. WHAT IMPACTS A UNIT'S AVAILABILITY AND WHAT IS DEC'S PHILOSOPHY FOR SCHEDULING REFUELING AND MAINTENANCE OUTAGES?

A. In general, refueling requirements, maintenance requirements, prudent maintenance practices, and NRC operating requirements impact the availability of DEC's nuclear system. Prior to a planned outage, DEC develops a detailed schedule for the outage and for major tasks to be performed including sub-schedules for particular activities.

The Company's scheduling philosophy is to plan for a best possible outcome for each outage activity within the outage plan. For example, if the "best ever" time an outage task was performed is 10 days, then 10 days or less becomes the goal for that task in each subsequent outage. Those individual goals are incorporated into an overall outage schedule. The Company aggressively works to meet, and measures itself against, that schedule. Further, to minimize potential impacts to outage schedules, "discovery activities" (walk-downs, inspections, etc.) are scheduled at the

earliest opportunity so that any maintenance or repairs identified through those activities can be promptly incorporated into the outage plan.

As noted, the schedule is utilized for measuring outage planning and execution, and driving continuous improvement efforts. However, in order to provide reasonable, rather than best ever, total outage time for planning purposes, particularly with the dispatch and system operating center functions, DEC also develops an allocation of outage time which incorporates unforeseen schedule delays that may be needed for unplanned equipment repairs found during inspections. The development of each outage allocation is dependent on maintenance and repair activities included in the outage, as well as major projects to be implemented during the outage. Both schedule and allocation are set aggressively to drive continuous improvement in outage planning and execution.

Q. HOW DOES DEC HANDLE OUTAGE EXTENSIONS AND FORCED OUTAGES?

A. When an outage extension becomes necessary, DEC expects that work completed in the extension results in longer continuous run times and fewer forced outages, thereby reducing overall fuel costs in the long run. Therefore, if an unanticipated issue that has the potential to become an on-line reliability issue is discovered while a unit is off-line for a scheduled outage and repair cannot be completed within the planned work window, the outage may be extended for the minimum time needed to perform necessary maintenance or repairs prior to returning the unit to service. In the event that a unit is forced off-line, every effort is made to perform the repair and return the unit to service as quickly as possible. DEC assesses potential causes of each forced

outage or extended outage and implements best practices moving forward. The nuclear industry recognizes that constant focus on operational excellence results in improved nuclear safety and reliability.

Q. WHAT OUTAGES WERE REQUIRED FOR REFUELING AT DEC'S NUCLEAR FACILITIES DURING THE REVIEW PERIOD?

A. There were four refueling outages during the review period; fall 2018 outages at McGuire Unit 2, Oconee Unit 1, and Catawba Unit 1, followed by a spring 2019 outage at McGuire Unit 1. All four refueling outages were completed within the scheduled allocation.

McGuire Unit 2 shut down for refueling on September 15, 2018. In addition to refueling, major pump and motor work included the 2C2 heater drain pump motor replacement, 2A2 component cooling pump motor replacement, 2B chemical and volume control system pump motor replacement, and the rebuild of the 2B nuclear service water pump. Electrical work included replacement of the 2B main step-up transformer, and installation, testing, and tie-in of the emergency supplemental power supply ("ESPS") diesel generators. The ESPS installations provide an additional source of backup power and allow additional flexibility to complete maintenance on the station's emergency diesel generators. The open phase detection modification was also installed. Other work performed included repair of the 2A low pressure turbine #4 bearing, turning gear replacement, and steam generator secondary separator inspections and repair. Insulation was replaced on the reactor vessel head and digital rod position indication head cables and coil stacks were replaced. After refueling, inspections, maintenance, and modifications completed, the unit returned to service

on October 13, 2018. The outage completed in 28.5 days compared to a schedule allocation of 29 days.

On October 19, 2018, Oconee Unit 1 was removed from service to begin a refueling outage. In addition to refueling activities, the Unit 1 switchyard power circuit breaker 18, main step-up transformer, and numerous molded case circuit breakers were replaced. The 1B2 reactor coolant pump ("RCP") rotating assembly was replaced and the 1B1 RCP motor bearing was repaired. Eddy Current testing was completed on all tubes in both steam generators. Turbine work included inspections and maintenance for the 1B low pressure turbine. After refueling, maintenance, testing, and modifications were completed, the unit returned to service on November 14, 2018, for a duration of 25.7 days compared to a schedule allocation of 31.75 days. After the conclusion of the refueling outage, the turbine was disconnected for 1.3 hours for turbine overspeed testing.

Catawba Unit 1 entered a refueling outage on November 17, 2018. In addition to refueling activities, the station completed inspections, maintenance, and modifications that improved safety margins and strengthened reliability. Major reliability pump and motor work included replacement of the 1A nuclear service water pump and motor, the 1C hotwell pump and motor, and the 1A condensate booster pump motor. Modifications completed included the installation of the open phase detection system and emergency diesel generator governor modifications that added slow start capabilities. Both modifications improve safety margins related to offsite and backup power. Turbine and feedwater work included inspections of the 1B low pressure turbine, the 1A main feedwater pump turbine, and inspections of the 1A

auxiliary feedwater pump turbine. Other significant inspections included Eddy Current testing on the Unit 1 steam generators, and control rod guide tube and Alloy 600 auxiliary head adapter encoded inspections. After inspections, maintenance, and modifications completed, the unit returned to service on December 11. 2018. The duration of the outage was 24.5 days compared to a schedule allocation of 28 days.

The fourth and final refueling outage during the review period began at McGuire Unit 1 on March 23, 2019. In addition to routine refueling activities and inspections, safety and reliability enhancing work was completed. Large pump and motor maintenance included the replacement of the 1B2 component cooling pump motor and the 1C reactor coolant pump seal. Electrical maintenance and modifications included installation and post installation testing of emergency supplemental power supply (ESPS) diesel generators, distributed control system upgrades, and replacement of the 1B main start up transformer. The electrical work and modifications improved safety margins and enhanced the unit's reliability. The ESPS modification also increased flexibility in emergency diesel maintenance scheduling, allowing significantly more EDG maintenance to occur while the unit remains online, reducing impacts during routine refueling outages. Inspections completed included the 1B low pressure turbine, 1B feedwater pump turbine, control rod guide cards, and reactor vessel head. All outage goals were met. After refueling, maintenance, modifications, and inspections completed, the unit returned to service on April 16, 2019; a duration of 24.75 days compared to a schedule allocation of 29 days.

Q. OTHER THAN REFUELING, WHAT OUTAGES OCCURRED AT DEC'S NUCLEAR FACILITIES DURING THE REVIEW PERIOD?

Three brief forced outages occurred during the review period. Oconee Unit 1 was removed from service for one week beginning November 30, 2018 to repair a leaking reactor coolant pump seal. McGuire Unit 1 entered a 4-day forced maintenance outage on April 26, 2019 to repair the 1B feed water pump turbine. On May 3, 2019, as operators were placing the McGuire Unit 1 pressurizer heaters in their normal alignment following the forced outage, the reactor tripped and the unit was offline for 1.8 days.

Q. DO YOU BELIEVE ANY OF THE THREE FORCED OUTAGES WERE CAUSED BY A FAILURE BY THE COMPANY TO MAKE REASONABLE EFFORTS TO MINIMIZE FUEL COSTS?

A. No, the brief forced outages were not caused by a failure by the Company to make reasonable efforts to minimize fuel costs. Based on my oversight and review of operations during the review period, the units were operated reasonably and prudently, and our operations were conducted in a way that minimized our fuel costs. In each case, the Company reviewed and investigated the causes of the events and implemented corrective actions to continually improve performance. The successful completion of four refueling outages and the achievement of a 96.05% capacity factor during the review period, validates the Company's performance.

Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes, it does.

Capps Exhibit 1

DUKE ENERGY CAROLINAS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR CAPACITY FACTOR PURSUANT TO S.C. CODE ANN. § 58-27-865(F)
REVIEW PERIOD OF JUNE 2018 THROUGH MAY 2019

1	Nuclear System Actual Net Generation During Review Period	60,411,472	MWH
2	Total Number of Hours during Review Period	8,760	
3	Nuclear System MDC during Review Period	7,180	MW
4	Reasonable Nuclear System Reductions	3,346,135	MWH
5	Nuclear System Capacity Factor	101.45	%

DUKE ENERGY CAROLINAS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR OUTAGE DATA FOR REVIEW PERIOD OF
June 2018 THROUGH MAY 2019

Nuclear outages during the Review Period

Station/Unit	Date of Outage	Reason for Outage
McGuire 2	9/15/2018 - 10/13/2018	Scheduled Refueling - EOC 25
Oconee 1 [1]	10/19/2018 - 11/14/2018	Scheduled Refueling - EOC 30
Catawba 1	11/17/2018 - 12/11/2018	Scheduled Refueling - EOC 24
Oconee 1	11/30/2018 - 12/8/2018	Forced Maintenance Outage
McGuire 1	3/23/2019 - 4/16/2019	Scheduled Refueling - EOC 26
McGuire 1	4/26/2019 - 4/30/2019	Forced Maintenance Outage
McGuire 1	5/3/2019 - 5/5/2019	Reactor Trip

[1] Following completion of refueling outage, Unit briefly disconnected from grid (1.3 hours) to complete turbine overspeed testi

DUKE ENERGY CAROLINAS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR OUTAGE SCHEDULE THROUGH BILLING PERIOD

Scheduled nuclear outages lasting one week or more through the Billing Period

Station/Unit	Date of Outage[1]	Reason for Outage

REDACTED

[1] This exhibit represents DEC's current plan, which is subject to change based on fluctuations in operational and maintenance requirements.